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Focal mechanism analysis of earthquakes using CAP method for the Eastern Indian shield region

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The seismotectonics of the Eastern Indian shield (EIS) region were studied using local and regional earthquake waveform data recorded during 2008-2017 at the regional seismic stations. The EIS contains two Archean cratons namely, Singhbhum Odisha craton (SOC) and Chhotanagpur Granitic Gneissic terrane (CGGT). The seismicity in EIS show a gentle north dipping trend, and is apparently controlled by local stress build-up. We initially have analyzed a total of 16 events of magnitude (Mw) 3.0 and above, and found waves of four events recorded at stations are quite good for focal mechanism inversion using cut and paste (CAP) method (Zhao and Helmberger, 1994; Zhu and Helmberger, 1996). Seismograms were decomposed and amplitude information was extracted over different time windows for P (25s) and S (60s) - waves to increase the stability and resolution of the inversion process. The CAP method allows a limited time shift between synthetic and the observed record to overcome the errors in the 1D model used for deriving Green's functions, locations and origin times of the four earthquakes. After revealing the focal mechanism, the scalar moment MO is assessed using least-square fit between amplitudes of the synthetics and records at all stations. A factor of 2 is chosen for the weighting of P wave relative to S wave in the waveform fitting. We use factors of 1.0 and 0.5 for P and S waves for distance scaling. In the grid search for the optimal source parameters, intervals of 1 km in depth and 6° in the angles of strike, dip and rake have been used. Finding the optimal value from the grid search for each source parameter, a final value of the parameter is determined by the minimum location of a 3-point second-order polynomial interpolation involving the optimal grid value and its two neighboring grid points. The focal mechanisms, derived from moment tensors obtained by inversion of full waveform data, indicate both strike-slip and normal faulting dominated movements. The P-axis trends along $\sim$ NE-SW to NNE-SSW in concurrence with the Indian plate motion. The prevailing stress in the region might be caused by the on-going tectonics of the Central Himalayan region.

Keywords: Green's function, Seismotectonics, Focal mechanism, CAP method, Eastern Indian Shield